FOREST PEST MANAGEMENT REPORT
REGION I - UPPER PENINSULA
May - 1991

FOREST TENT CATERPILLAR

Forest tent caterpillar (FTC) populations and defoliation will be much reduced in 1991 compared to previous years (See Table Below). Eggmass surveys conducted in Chippewa and Menominee Counties reveal declining populations. Egg mass counts of greater than 20 in a 5 minute search of the crown of a felled tree represent high FTC numbers. In 1990, egg mass numbers were consistently greater than 20/tree. In 1991, egg mass counts of 0 to 6 per tree were encountered with an occasional count of 12/tree. Some visible defoliation can be expected. Acres of defoliation will be much reduced.

High value hardwoods which showed signs of stress last year from defoliation and/or drought should be sprayed this year if heavily infested. Homeowners are urged to water valued yard trees during dry spells. Remember, Dipel & Thuricide (B.t. containing biological insecticides) are effective only when sprayed on foliage which is eaten by the caterpillars. If yards or caterpillars are to be sprayed, use materials such as malathion, carbaryl or diazinon. Polyethylene (plastic) sheets wrapped around tree trunks is said to prevent caterpillars from crawling up the tree - especially if sprayed with cooking oil. Black ground beetles and grey "house flies" which prey upon the FTC larvae will likely be abundant again this year. The flies do not bite!

FOREST TENT CATERPILLAR - ACRES OF DEFOLIATION
BY COUNTY AND YEAR OF DEFOLIATION

	Year		
County	1988	1989	1990
Alger	11,400	62,080	13,960
Baraga	640	5,062	
Chippewa	165,760	189,750	234,000
Delta	24,320	151,360	170,000
Dickinson	21,270	4,640	5,120
Houghton	2,560		
Keweenaw	800		
Luce	7,040	29,760	10,400
Mackinac	65,920	31,040	60,160
Marquette	12,160	152,540	62,840
Menominee	2,320	39,040	53,680
Ontonogon	5,120		
Schoolcraft	10,280	36,160	45,920
Total Acres	329,590	701,432	656,080

EASTERN TENT CATERPILLAR

The eastern tent caterpillar (ETC) has defoliated cherry and apple trees for the last four years. These populations may collapse in the U.P. this year. They share predators and parasites with the FTC. Unlike the FTC, the ETC constructs a webbed tent in attacked trees. These webbed tents become visible in the U.P. beginning in mid-May. They grow until early June, and can encompass large portions of the tree. They prefer cherry and apple trees, but other trees are occasionally attacked. Tents are formed in tree branches and branch crotches. The tents and caterpillars can be removed by hand, or the foliage can be sprayed with a biological insecticide such as Dipel, Thuricide or Sok-Bt, or chemical sprays such as Malathion or Carbaryl can be used. Spraying the tent is not effective. The tent protects the caterpillars by serving as a moisture barrier. Spraying the leaves exposes the caterpillar to the insecticide as they feed at night. If the tent is opened to spray inside, a chemical spray must be used. The biological sprays must be eaten to be effective. Burning these tents can harm the tree, and can start larger fires during dry conditions.

GYPSY MOTH

The gypsy moth is established throughout the Lower Peninsula. Movement of the gypsy moth into the U.P. on recreation vehicles, firewood and outdoor furniture is occurring. This movement is documented annually by the Michigan Permanent Trapping Program. This program was initiated in 1985 by the Michigan Department of Agriculture (MDA) in cooperation with the MDNR and U.S. Forest Service. The entire state is sampled each year by placing two pheromone traps per township. These traps attract and trap male gypsy moths. The 1990 trap catches show significant moth catches as far west as Luce County. Portions of Eastern Chippewa County have establishing populations.

An isolated establishing population was detected in Houghton County in the U.P. The MDA is committed to an early detection and suppression program to prevent the gypsy moth from establishing in the U.P. Thus, 40 acres in Houghton County will be sprayed three times with a biological insecticide (containing B.t.) in late-May-early June. This will be an attempt to eradicate this remote infestation.

In the Lower Peninsula, 1991 defoliation is expected to approach 400,000 acres. This is a continued increase from last years 358,000 acres and 1989's 290,000 acres. This increase is expected to continue until all the most vulnerable forest type - oak and aspen (2.9 million acres) - has been affected. Once this occurs, populations will begin to cycle at 7-12 year intervals. Michigan has an estimated 12 millions acres of forest with differing levels of susceptibility to gypsy moth defoliation. Private, residential lands in the Lower Peninsula have been sprayed with Bt (a biological insecticide) as part of a cost-share suppression program coordinated by the Michigan Department of Agriculture (MDA). This protects foliage and reduces nuisance values in residential and recreational areas.

JACK PINE BUDWORM

The Baraga Plains, Danaher Plains, Kingston Plains and jack pine areas of northern Luce County will experience defoliation again this year. A wide-spread, low level insurgence was detected last year. We expect moderate to heavy defoliation of many of the jack pine areas of the U.P. in 1991. A list of jack pine stands sorted by cords and risk of jack pine budworm loss will be provided each District and Area office. After 1991 defoliation levels are assessed, this information will be updated to provide a list of stands at risk. Last year's aerial survey of U.P. jack pine on state and private land was flown in July. The results are shown in the following Map and Table.

Budworm larvae begin feeding in male cones in May. Defoliation is evident by mid-June. The larvae finish feeding by the first of July. By this time, clipped needles webbed to the branches are brown - highlighting defoliated crowns with a brown cast. This brown coloration is reduced as the summer progresses because heavy rains and wind remove these clipped needles from the crown.

JACK PINE BUDWORM DEFOLIATION - 1990

County	State	Private
Baraga	4,480	0
Chippewa	1,280	0
Luce	11,520	0
Schoolcraft	6,400	0
Totals	23,680	0

IPS - BARK BEETLES

Pine bark beetle (Ips) populations are much reduced from the drought years of 1987-88. If rainfall is near normal for 1991, bark beetle populations will remain low, and drought stressed trees should recover much vigor. Vigorous trees do not attract beetle attacks, and can better withstand other stressing factors such as the predicted jack pine budworm epidemic to minimize bark beetle complications. Bark beetles are normally found attacking stressed or freshly killed pines.

YELLOW-HEADED SPRUCE SAWFLY

Watch for defoliation of small and ornamental spruce. The yellow-headed spruce sawfly (YHSS) will quickly kill small spruce and seriously degrade spruce xmas trees. Vigilant monitoring is advised. Eggs are usually laid as bud caps are shed. Larvae then emerge in the next 7-14 days - but can emerge as late as July. For valued ornamental trees, spray larvae with malathion or carbaryl. If larvae are very small, either wait a few days to spray to insure complete egg hatch, or spray and continue to monitor and spray again if larvae are detected. Monitor for 2-3 weeks after initial egg hatch. Christmas tree plantations with YHSS can be sprayed 10 days after bud caps are shed with a material like Sevin XLR which has a residual effect for 2-3 weeks.

OAK WILT

Oak wilt was detected in the Shakey Lakes Area of Menominee County in 1981. It was likely introduced into the area in the early 1950's. Control efforts began in 1982. All 236 detected epicenters have vibratory plow lines established to stop root graft transmission of the disease. Most epicenters have either had the trees inside the plow lines herbicided or harvested to remove the source of oak wilt spores. These spores are carried by sap beetles to inoculate fresh oak wounds in May and June. Removing this source of inoculum will prevent the occasional over-land spread of the disease. Until all infected trees are treated, oaks should not be pruned or otherwise wounded in May or June. Cutting restrictions are in force on all state lands in the this area until inoculum sources are removed - hopefully by the end of the 1991 field season.

Over 5,000 trees have been lost either directly from oak wilt or indirectly by control actions. Many of these are valued landscape trees. Without a control program, we would lose most of this unique, 10,000 acre oak resource.

This control project is a cooperative effort funded by the Michigan Department of Natural Resources and the Michigan Department of Agriculture with support funding from the Menominee Board of Commissioners and Lake Township. Michigan Technological University is supervising and researching control efforts. The Michigan State University Cooperative Extension Service, Menominee County is helping with landowner contacts and public relations.

DROUGHT AFFECTS ON FOREST HEALTH

The extreme drought of 1987-88 is the largest single factor contributing to U.P. forest health problems of the past 4 years. Although 1989 had near normal rainfall, we entered the 1990 growing season with below normal rainfall. Fortunately, 1991 has began as a wetter than normal year.

The following is an excerpt from Minnesota's Forest Insect & Disease Newsletter:

> Trees use water as a raw material in the process of photosynthesis. In effect, water has several functions, all of which are necessary for a healthy tree. One, water is a critical element in photosynthesis, the process by which the tree captures and stores energy by manufacturing sugar using sunlight, CO_2, and water. If water becomes limiting, the trees ability to store energy is reduced. Two, water is used by the leaves to facilitate the gathering of the CO_2, used in photosynthesis. In effect, plants maintain a water film in special spaces inside the leaf. The CO_2 in the atmosphere dissolves into that watery film and is then transported to the cells that undertake photosynthesis. If water becomes limiting, adsorption of CO_2 is limited.
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> In addition, water plays a major role in the transport of chemical elements from the roots to the leaves and in the cooling of the leaves on a hot day. Water has many uses, but they all come down to a simple fact, without water a tree is unable to store energy. Energy to be used the next year to make new leaves. Energy to have buds, wood, and keep the tree alive over the winter. Energy to defend the tree when it is attacked by insects, fungi, nematodes, or other pests.
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> Presuming that the drought is over or, more likely, is fading away, what do trees need now? Time. They need time to rebuild their crown and then time to use that crown to photosynthesize and store energy. Also, water yard trees during dry spells with 1" of water per week (Note: by soaking ground at periphery of tree canopy). But do not fertilize stressed trees in the spring. This encourages a larger crown and requires the tree to use more of its severely limited energy reserves to make additional leaves. (Note: Energy which may be needed for the trees defenses, root growth, or may severely deplete needed energy reserves to combat future stresses. Fertilize trees in the fall during or after leaf fall to encourage root development which translates into vigor the following spring.)

OAK MORTALITY/TWO-LINED CHESTNUT BORER

Oaks in many portions of the U.P. were greatly stressed by the 1987-88 drought. Oak is a drought intolerant species. Drought stress alone has predisposed oak to losses from secondary pests like the two-lined chestnut borer (TLCB) and armellaria root rot. Where the forest tent caterpillar (FTC) defoliated these already drought-stressed trees, they became susceptible and vulnerable to the TLCB. Thus, scattered pockets of oak mortality were common in these areas. These pockets ranged in size from a few trees to several acres.

In 1990, TLCB mortality in FTC defoliated oak stands in southwest Menominee County was severe. This area contains a 10,000 acre oak forest which is unique to the U.P. Pockets of mortality ranged from several trees to 30 acres in size. An aerial survey was flown in late-August with a near-infrared video camera to map pockets of mortality (See Map). Four pockets greater than 20 acres in size, and numerous 5-10 acre pockets were detected. Approximately 300 acres of oak mortality in pockets larger than an acre were found. In addition, the entire oak resource had single dead oaks scattered throughout.

This situation should improve with near or above normal rainfall in 1991. In this case, stands without TLCB activity last year will probably not be attacked in 1991. Oak stands with TLCB caused dieback and mortality will likely experience some additional dieback and mortality. Stresses caused by logging, or FTC defoliation could be detrimental on or near last year's problem sites - especially if we have a dry summer.

GUIDELINES TO MANAGE OAK:

1. Oaks with >50% crown dieback will likely die in 1991.

2. Oaks with >20% crown dieback which are infested by the TLCB are at high risk. Actions such as watering and spraying for FTC (if needed) will reduce risk of tree mortality.

3. Do not open oak stands by cutting living trees. Opening a stand will increase evapotranspiration (moisture loss) further predisposing trees to TLCB and Armellaria; and Armellaria can colonize residual stumps. Healthy stands can be thinned to increase vigor - but, maintain a full stocking.

4. Remove and dispose of declining oaks by July 15 if trees do not leaf out, if leaves show obvious signs of stress (small & sparse), or if leaves turn color in mid-summer.

5. Completely cover oak firewood killed in 1990 from May to July 15 with a heavy plastic tarp, or remove from oak area.

6. Fell infested trees during July when larvae are relatively young. Young larvae are very sensitive to rapid drying of host tissues. Felling in August or later is too late.

GUIDELINES TO MANAGE OAK (CON'T):

7. Girdle living, infested oaks in May. The girdled tree will serve as a "trap tree" and TLCB beetles will lay eggs in them. These trees will dry before beetles can fully develop. Girdle trees close to the ground line. Bark areas below the girdle will support beetles for next years population.

8. In August or later, cut infested branches well below the dead portion of the branch. Look for wilting or brown leaves in August until leaf-fall. The larvae girdle the branch below where the leaves are brown. These materials should be burned before next May.

MAPLE DECLINE

Areas of declining maple can be found in the Central and Eastern U.P. Northern Menominee and Western Delta counties have a few areas where stands have 50% of the basal area dead or severely declining (top 1/2 of tree dead). These sites are primarily on poorly drained soils, shallow soils over limestone or clay ridges. Dead trees and tree tops in these areas have wounds associated with the wound invading fungi Irpex mollis and Stereum gausatatum. Less serious declines can be found on good sugar maple sites defoliated by FTC for 2-3 years during the drought of 1987-88. Our prime sugar maple areas in north central and the Western U.P. have no reported symptoms of decline.

ASPEN

Aspen in Chippewa and Mackinac Counties have been defoliated by the forest tent caterpillar for the last 3-4 years. In 1989-90 they were defoliated for a second time in late-summer by the Large Aspen Tortrix. These stresses in addition to the 1987-88 drought have produced weakly foliated aspen in many areas of the Eastern U.P. We will watch closely for signs of decline caused by agents like Armellaria root rot.

SALT INJURY - WHITE PINE

White pine is especially sensitive to road salt. The affects of a long winter with corresponding multiple applications of road salt is particularly evident this time of the year. The foliage of large trees is burned by salt splashing primarily on the road-side of the tree. The tops of smaller trees are burned, again with the most severe burning on the road-side. Low branches protected by snow cover are unaffected. Winds can carry salt-laden moisture to the tops of the tallest white pine and to trees well off the road rights-of-way. A prevailing wind pattern will cause more extensive white pine injury on one side of the road.

WINTER INJURY

The following is an excerpt from the May issue of the "Minnesota Insect & Disease Newsletter".

Young seedlings and saplings are most susceptible to temperature extremes and dehydration in the spring. Winter injury to hardwoods is rarely evident until spring, when the buds don't open or the expanding leaves wilt or look tattered. Injury to conifers is evident in late winter and during the spring when the foliage discolors, usually turning red, starting at the needle tips.

There are four types of injury related to cold temperatures and dehydration: sunscald, winterburn, winter drying and frost damage.

Sunscald occurs anytime during the winter or early spring when the bark has thawed due to the warmth of the sunshine, but the air temperature is still below freezing. Sunscald is caused by the lethal freezing of water in the stem and bark after the warming sunlight is decreased or blocked. Thin-barked trees and saplings are particularly susceptible. Damage is found on the south or southwest sides of the tree. Look for cracked bark, sunken cankers, and, if the cambium and sapwood are killed, loose bark with dead sapwood below.

Winterburn occurs in the late winter, well before budbreak. At this time of year, plant metabolism is slowly reactivating. Water is moving in and out of cells. Winterburn is due to water freezing inside plant cells. If enough cells are killed, leaf or twig tissues are killed. They happens when a temporary warm spell is suddenly broken by very cold weather - freezing cell water. Winterburn can also happen when the warming sunlight is suddenly blocked and the needles rapidly cool - freezing cells. On conifers, the needles turn red and sometimes buds are killed. When hardwood buds and twigs die, multiple shoots sprout below the dead tissues on the stem. Winterburn is most common on the south and southwest exposures of trees and plantations.

Winter drying occurs in late winter and early spring when warm, dry winds desiccate needles and twigs. At this time of year, roots are not active and water in the soil is frozen, but the shoots and needles are transpiring. There isn't any water to transport to the shoots, so needles progressively dehydrate as they transpire. Affected needles turn red from the tip down and often have a mottled appearance. Buds are usually not killed. Normally, snow cover prevents winter drying of young conifers by providing shelter from drying winds and by preventing deep frost formation in the soil. In some years it's common to see young conifers with a strong line of demarcations separating the brown, desiccated tops from the healthy, green branches that were snow covered.

WINTER INJURY (CON'T)

Frost injury occurs in the early spring, prior to, during and after budbreak. New, expanding shoots are particularly susceptible. Ice crystals form inside cells and tissues, killing them. Conifer shoots droop and turn red or straw-colored. Frost damage is more severe on conifers because no new shoots develop to replace the frost-killed shoots.

Hardwood leaves can be damaged while still in the bud. After they expand, the leaves have holes in them or look altered. Frost-killed leaves turn black, are shed and then replaced.